Rimstone and Travertine Dam Rebuilding

Jerry L. Trout

Rebuilding rimstone and travertine dams, when properly orchestrated, provides instant aesthetic improvement and is among the most visually enhancing and rewarding of all formation repairs. When water fills the pockets, pond, pool, or lake behind the rimstone dams, it often appears as if the entire scenic gallery is restored. Rimstone dam repairs sometimes achieve lasting benefits. When the rebuilt dams refill, populations of natural cave organisms may replenish, deposition or corrosion patterns may reestablish, and the presence of water may help deter new breakage.

Rimstone and travertine dams, easily trampled underfoot, are among the most frequently damaged speleothems. Dam configurations have tremendous variations.

- From paper-thin to several inches of thickness
- From only a narrow line a few millimeters high to several feet tall
- From thick but fragile to extremely delicate.

Dams or gours are not difficult to repair, except when they are very thin or very tall. Dam repair is best accomplished with mortar-mix cement. Varying the amount of lime in cement will create a stiff, workable consistency, depending on the moisture present and the inherent height or thickness of the damaged area. (See concrete, page 179; also see Portland cement, page 369.)

Ace Hardware® products like Fast Concrete Patch® or Quick Plug® are good options. Similar products with differing brand names are found at hardware stores and construction supply outlets.

Figure 1. Tall, winding rimstone dams border a large, intermittent pool in Hidden Cave, New Mexico.

Rimstone Dam Repair

- Clean all mud and debris from rimstone.
- Hand sculpt the quick-setting cement (10–30 minute set time).
- Mold and texture it with gloved hands and tools.
- Repaired areas should hold water.

Figure 2. Quick-setting cement products are the recommended materials for reconstructing and sculpting broken rimstone dams.
All cements will cure slowly in caves with cool temperatures and high humidity. The lower the temperature and the higher the humidity, the longer cement materials will take to set and cure.

**Materials**

**Mortar Mix.** Use mortar mix when the thickness of the dam needs to be at least 1/2 inch (1.25 centimeters). The height of the repaired section should be no more than 8 times its thickness. Add increased amounts of lime for taller or thinner repairs. More lime (calcium oxide or calcium hydroxide) makes the cement mix set quicker. There is no particular formula for the amount of lime to add—however, if more than 10% is needed for the right consistency, a different repair material should be chosen. (See low-content calcium hydroxide, page 170 and page 369.)

In caves where temperatures range from 50–65° F (10–18° C), mortar mix will take approximately 1–4 hours to set, and 3–4 days to cure. Lower temperatures will lengthen both the set and cure times—warmer temperatures will shorten those times. Set and cure times are also extended if cave humidity exceeds 95%.

**Fast Concrete Patch.** This product can be purchased from Ace Hardware. Similar products are available elsewhere. Use for repairs when the rimstone dam thickness is less than 1/2 inch (1.25 centimeters) or the height is more than 8 inches (20 centimeters). In caves, Fast Concrete Patch will typically take about 20 minutes to set and 1 hour to cure.

**Quick Plug Hydraulic Cement.** This product is available through Ace Hardware. Use a quick hydraulic cement if the repair site is wet (also works for underwater repairs). Quick Plug has successfully served in rebuilding dams as thin as 1/8 inch (3 millimeters) and 7 inches tall (18 centimeters). In caves, Quick Plug typically takes about 4 minutes to set and about 45 minutes to cure.

**Coloring Agents.** Obtain coloring agents for concrete from almost any hardware store or construction supply outlet. Read the labels and avoid coloring agents containing ingredients that may be toxic to cave-dwelling organisms. Choose natural products made of materials that will not harm cave ecosystems.

Experiment with coloring agents from within the cave—cave soil, crushed cave rocks, drill dust, or powdered material from irreparably damaged speleothems.

**Tools for Rimstone and Travertine Repair**

**Wire brushes.** Use new stainless steel brushes (no brass or other metals that rust or mar).

**Paintbrushes.** Use new brushes with nylon bristles.
Figure 3. Thoroughly clean the repair area. Remove mud and debris before attempting to reconstruct rimstone dams with cement products.

Figure 4. Jerry Trout uses quick-setting cement to manually sculpt missing pieces of rimstone.

Figure 5. Use trowels, brushes, wires, and sculpting tools to shape the cement and match the texture of reconstructed sections to the original. Wear disposable vinyl gloves to help protect cavers’ hands.

Figure 6a. These three photos show the progression of rimstone repair in Happy Jack Cave, Arizona. First, clean the repair site. All surfaces should be as wet as possible before applying patching materials.

Figure 6b. Next, use gloved hands and various tools to sculpt cement and fill in missing sections of the rimstone dams.

Figure 6c. This view shows the completed rimstone dam. Repaired rimstone dams should retain water like the originals.

Toothbrushes. New toothbrushes are best. Designate them for repair.
Trowels. Both small and large are handy.
Sponges. The soft, car-wash type works best.
Wire. Stainless steel is best, but other types are okay for temporary use.
Paper clips. Use for texturing.
Water. Bring water if the cave is very dry.
Duct tape. Make forms for rimstone cement.
Buckets and containers. Use for mixing.
Stirring paddles or wooden spoons. Use for mixing.
Surgical gloves. Nonlatex, powder-free gloves are best.
Goggles. Wear eye protection.
Drop cloth. Protect cave surfaces when mixing and coloring.
Thick garbage bags. Transport all mixing materials in bags.

Methods and Techniques

Surface Preparation
Remove all loose materials with wire brushes, paintbrushes, sponges, and water. Surfaces should be clean of dirt and loose debris. All surfaces prepared to receive cement repairs should be as wet as possible before applying the patching materials.

Mixing
Mix all cement patch materials in a clean container with a 3:1 ratio—that is, 3 parts powder to 1 part water. Mixtures are typically adjusted according to environmental conditions. The consistency should be very thick, much like ready-mix concrete. In other words, the mixture should be as thick as possible, yet remain workable.

If possible, compare color matching outside the cave, in the sunlight. If it is not possible to take the materials or samples out of the cave, use a very bright white light—a broad beam, full spectrum light is preferred. Remember that most concretes will cure to a lighter shade after they are completely dry.

Application
Using gloved hands, trowels, and brushes, apply and shape the cement as required to fill in the missing pieces. Take care to match the thickness and shape of the original dam. Where large pieces are missing, mimic the patterns of the original dam by matching the texture and design of the remaining natural sections. If possible, use photographs of the dam that were made before the damage occurred.

A length of stiff tape—duct tape for example—is sometimes used to give stability to the repair while adding layers of cement. Remove the tape as soon as the concrete begins to cure.

If the dam repair is thin or several inches high, let each layer set up before adding subsequent layers. In some cases, the repair will take several sessions—allow each layer to set before adding the next, but all layers need to be added before the foundation layers completely cure. We have had success in reconstructing dams up to 4.5 feet tall (1.3 meters) and less than 1 inch thick (2.5 centimeters).

Do the final texturing with gloved hands and a variety of tools such as small paintbrushes, toothbrushes, sponges, wire, paper clips, and so on.

Clean up
Remove all patching material debris, tools, equipment, and packs in spill proof bags. Wash skin and tools immediately. Large amounts of water and soap are required for thorough cleaning of tools used in cement jobs.